

METALLO-ORGANIC DECOMPOSITION (MOD)  
FILM DEVELOPMENT

ELECTRINK, INC.

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## MOD Film Materials (Materials Made)

| <u>I</u> | <u>Organometallic Compound</u>           | <u>Purpose</u>   |
|----------|--|--|
| A        | Silver neo decanoate                     | contact and circuit conductors                                       |
| B        | Bismuth 2-ethylhexanoate                 | adhesion enhancer for use in mixed organometallic solutions          |
| C        | Platinum 2-ethylhexanoate                | to improve solder leach resistance in mixed systems                  |
| D        | Nickel neo decanoate<br>2-ethylhexanoate | reduced cost solder leach resistance agent, barrier film possibility |
| E        | Gold 2-ethylhexanoate                    | contact and circuit conductors                                       |
| F        | Aluminum neo decanoate                   | back surface field alloy<br>ceramic layer                            |
| G        | Mixed organometallics                    | various, eg. see above   |

# PROCESSING

## MOD Film Materials (Compound Information)

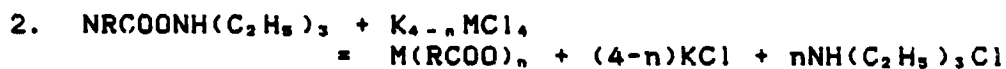
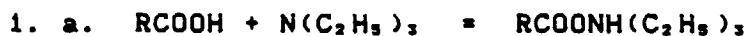
| Product Compound                                    | % Metal in compound | Decomp Temp. °C | Reagent compound                  | Metal Density gm/cc | metal Valence |
|---|---------------------|-----------------|-----------------------------------|---------------------|---------------|
| Ag(C <sub>7</sub> H <sub>15</sub> COO)              | 38.7                | 230             | AgNO <sub>3</sub>                 | 10.5                | <u>1</u>      |
| Bi(C <sub>7</sub> H <sub>15</sub> COO) <sub>3</sub> | 32.7                | 250             | Bi(NO <sub>3</sub> ) <sub>3</sub> | 9.8                 | <u>3</u> , 5  |
| Pt(C <sub>7</sub> H <sub>15</sub> COO) <sub>2</sub> | 40.5                | 210             | K <sub>2</sub> PtCl <sub>6</sub>  | 21.4                | <u>2</u> , 4  |
| Ni(C <sub>7</sub> H <sub>15</sub> COO) <sub>2</sub> | 14.6                | 310             | Ni(NO <sub>3</sub> ) <sub>2</sub> | 8.9                 | <u>2</u> , 3  |
| Ni(C <sub>7</sub> H <sub>15</sub> COO) <sub>2</sub> | 17.0                | 300             | "                                 | "                   | " "           |
| Au(C <sub>7</sub> H <sub>15</sub> COO) <sub>3</sub> | 27.7                | -               | KAuCl <sub>4</sub>                | 19.3                | 1, <u>3</u>   |
| Au(C <sub>7</sub> H <sub>15</sub> COO) <sub>3</sub> | 31.4                | -               | "                                 | "                   | " "           |
| Al(C <sub>7</sub> H <sub>15</sub> COO) <sub>3</sub> | 5.9                 | -               | Al(NO <sub>3</sub> ) <sub>3</sub> | 2.7                 | <u>3</u>      |

## MOD Film Materials (Chemical Reactions)

### A Strong Acid Salts



### B Weak Acid Salts



RCOOH is either neodecanoic acid, C<sub>7</sub>H<sub>15</sub>COOH or  
2-ethylhexanoic acid, C<sub>7</sub>H<sub>15</sub>COOH.

M is metal which has a valence n.

## PROCESSING

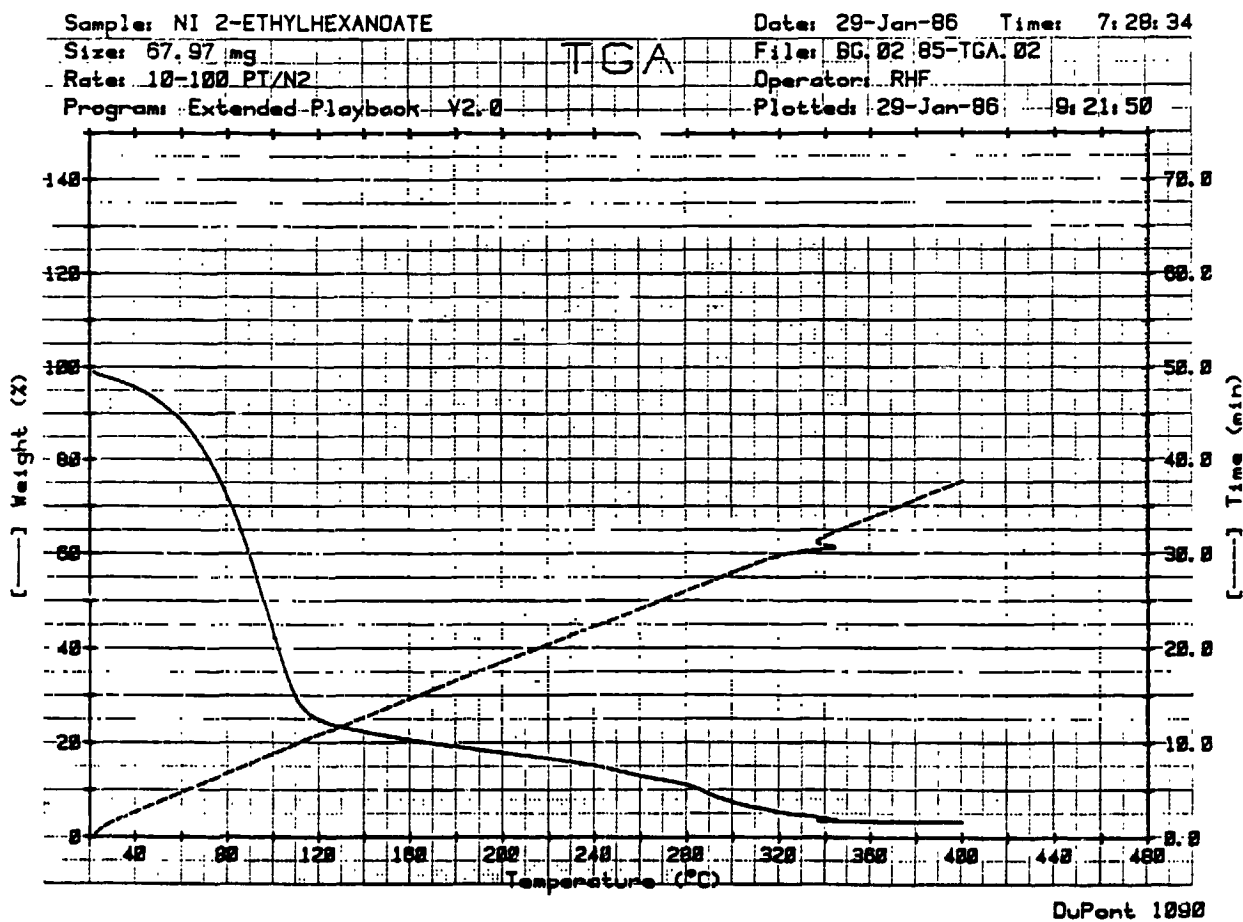
### Mixed Organometallics

The adhesion of silver Metallo-Organic Decomposition (MOD) films is substantially improved by a small addition of bismuth which after oxidation during firing may serve as a bonding frit. Solder leaching of the metal film is reduced by the addition of a small amount of platinum. Both the bismuth and the platinum are added to the silver neodecanoate in xylene as the 2-ethylhexanoate. This mixed solution is designated AGS 13.30 and has the composition given in the table below.

| Solution Composition         |                                 |                              |                              |                            |
|------------------------------|---------------------------------|------------------------------|------------------------------|----------------------------|
| Compound                     | %<br>Compound<br>in<br>Solution | %<br>Metal<br>in<br>Compound | %<br>Metal<br>in<br>Solution | %<br>on<br>Metal<br>Solids |
| Silver<br>Neo Decanoate      | 30.00                           | 38.7                         | 11.61                        | 95                         |
| Bismuth<br>2-ethylhexanoate  | 0.37                            | 32.7                         | .12                          | 1                          |
| Platinum<br>2-ethylhexanoate | 1.21                            | 40.5                         | .49                          | 4                          |
| Xylene                       | 65.42                           | -                            | -                            | -                          |
|                              | 100.00                          |                              |                              | 100                        |

# PROCESSING

## Thermogravimetric Analysis: Ni 2-Ethylhexanoate

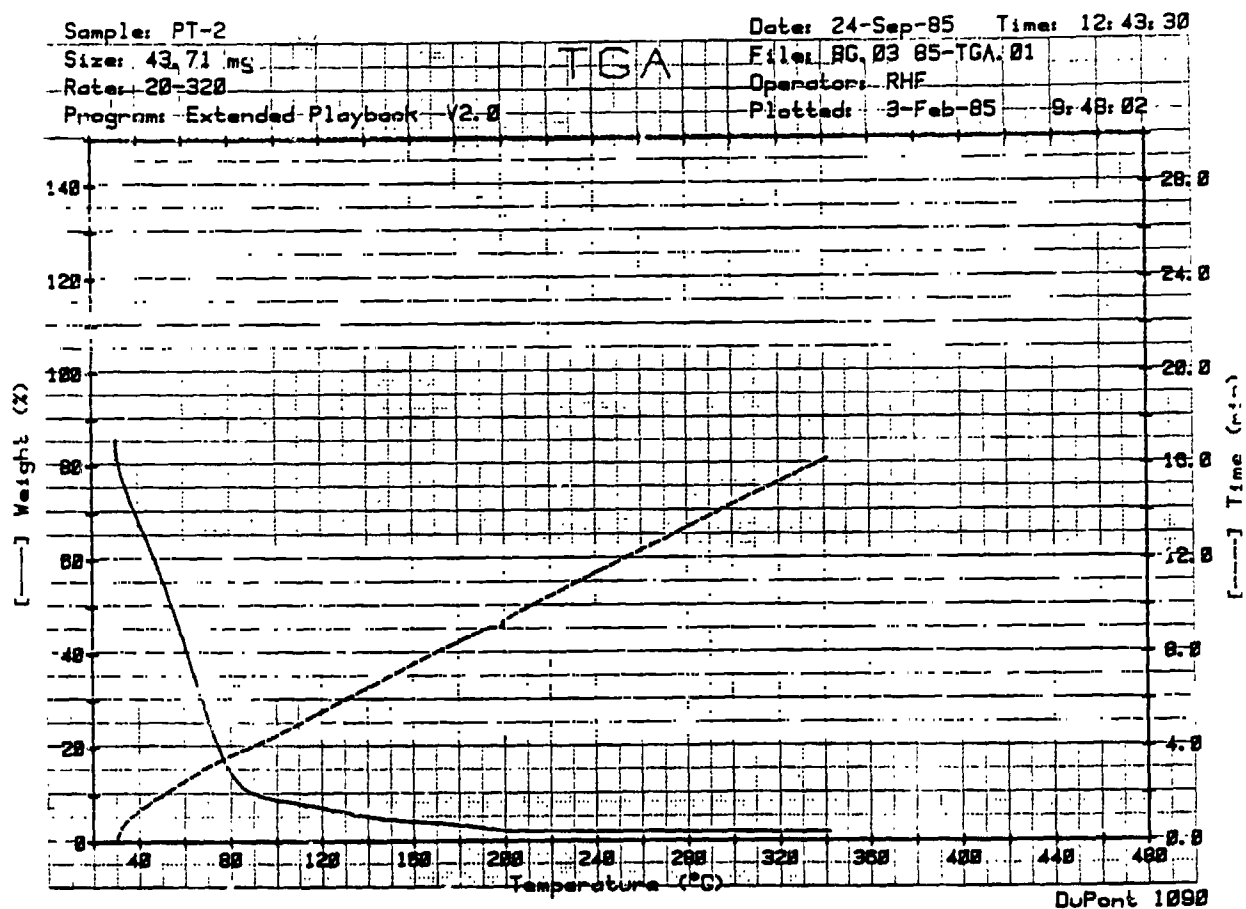


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PROCESSING

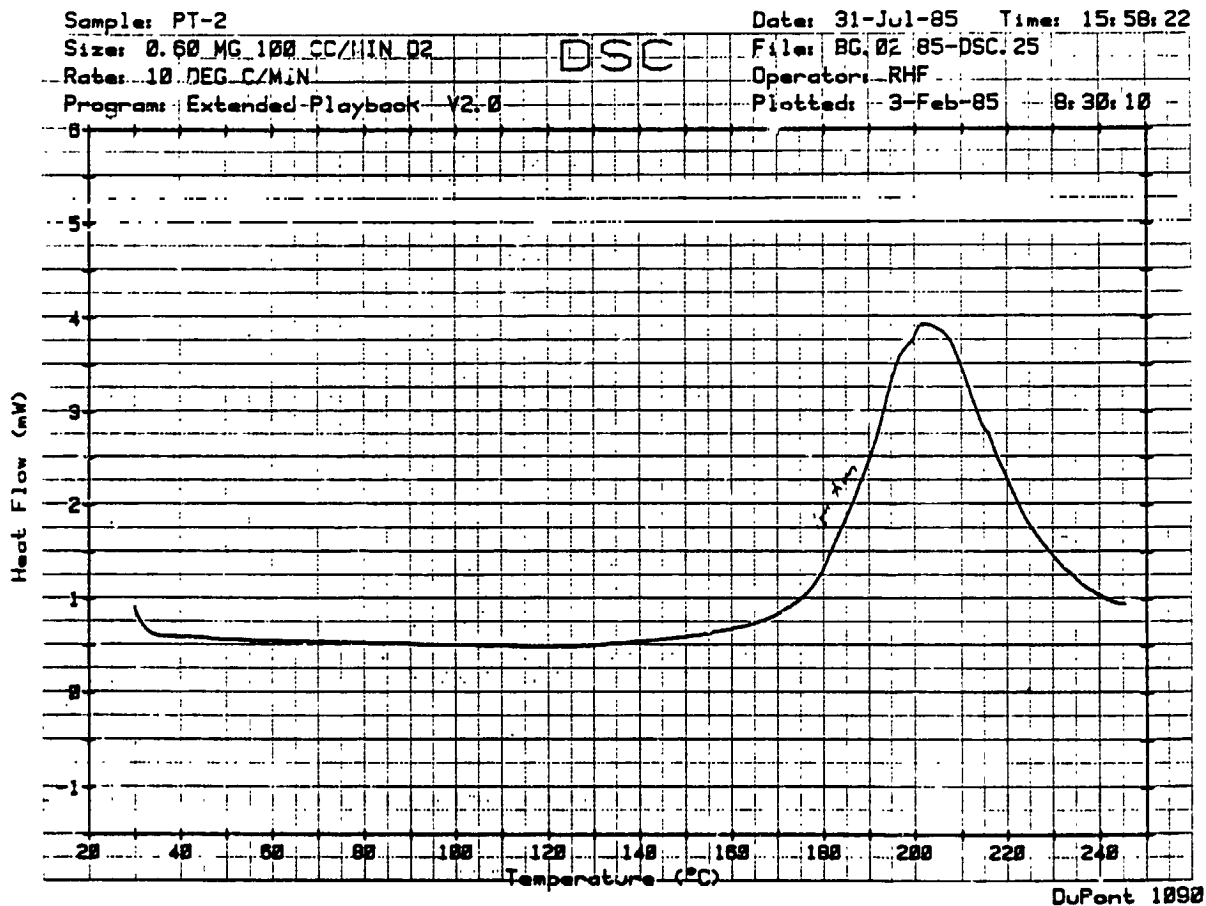
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Thermogravimetric Analysis: Pt 2-Ethylhexanoate



# PROCESSING

## Differential Scanning Calorimetry: Pt 2-Ethylhexanoate

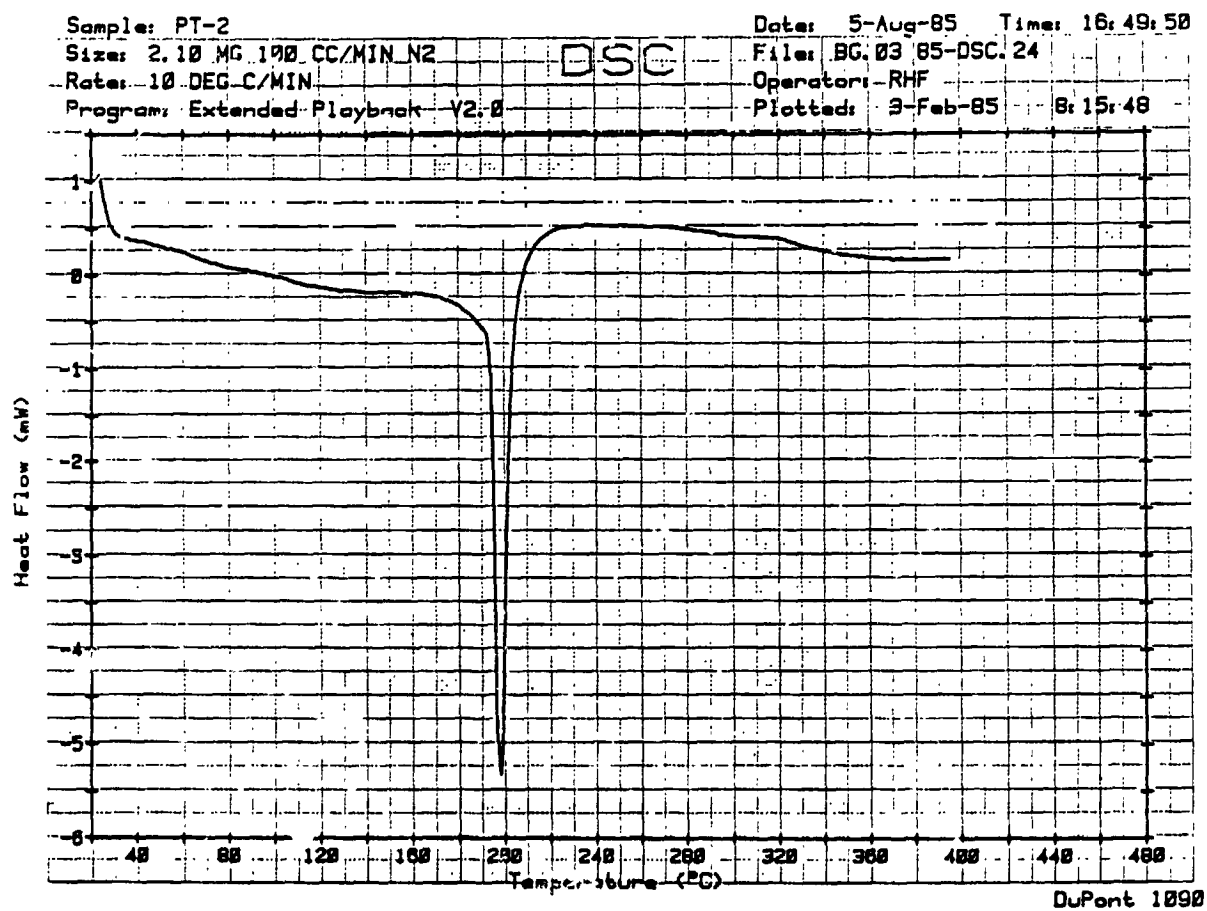


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PROCESSING

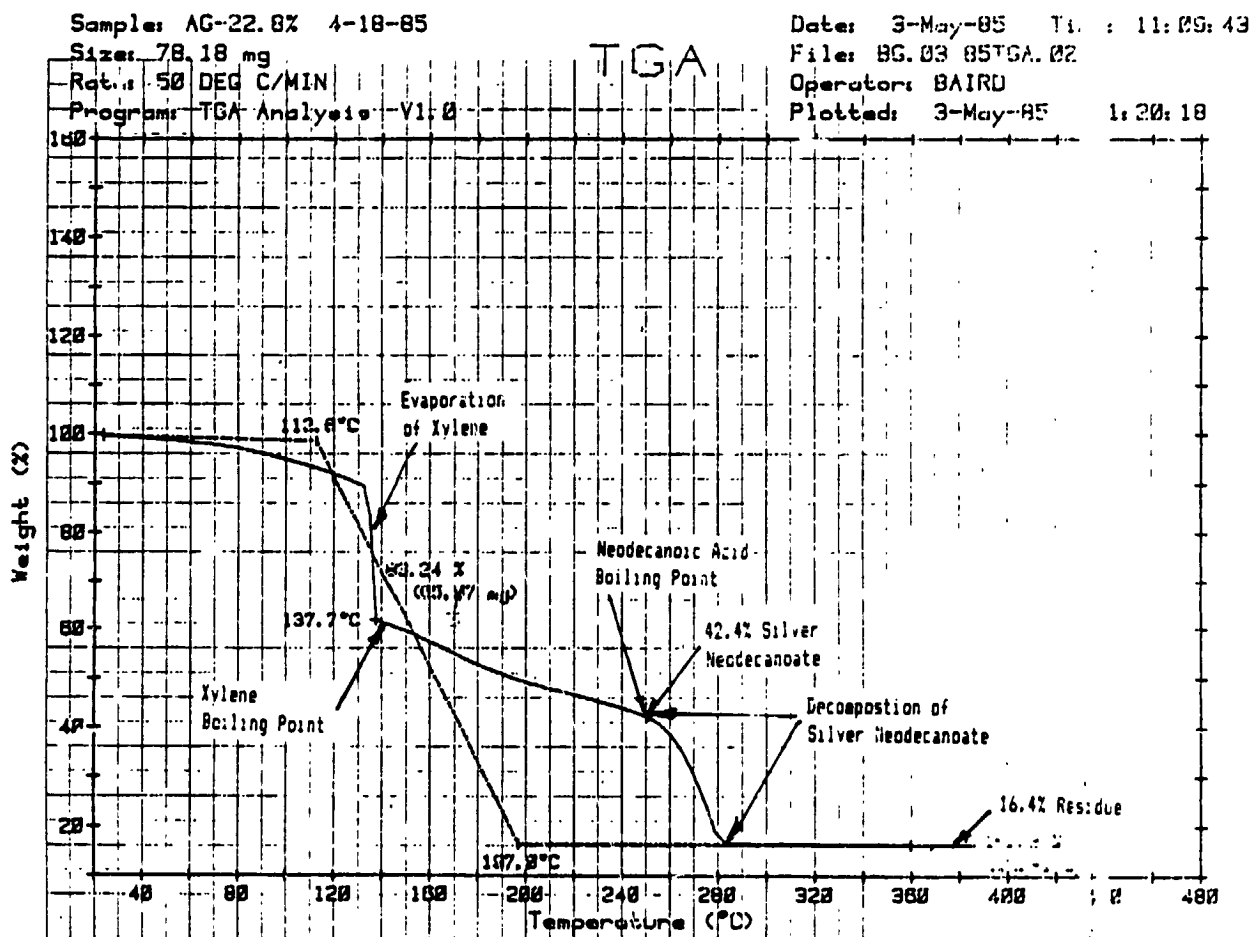
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Differential Scanning Calorimetry: Pt 2-Ethylhexanoate



# PROCESSING

## Thermogravimetric Analysis of 42.4% Silver Neodecanoate in Xylene (50°C/min)



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# PROCESSING

## Differential Scanning Calorimetry of 23% Silver Neodecanoate in Xylene (10°C/min)

Sample: SILVER INK Ag<sub>23</sub> in xylene  
Size: 38.6 MG  
Rate: 10 DEG C/MIN IN AIR  
Program: Interactive DSC V2.0

DSC

Date: 1-Dec-83 Time: 11:21:09  
File: BG.02 83-DSCDAT-31  
Operator: FRONSON  
Plotted: 7-Dec-83 10:57:50

